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⑤④ Container and lid.

⑤⑦ A one-piece tightly fitting, molded plastic lid intended to be used in association with a container having a laterally protruding lip extending about the perimeter of its mouth. In each embodiment of the invention the plastic lid is provided with a surrounding depending sidewall having a relatively thin upper web segment which is adapted to deform heightwise to conform to the shape of the protruding container lip as the lid is fitted onto the container. The lower region of the lid sidewall has a resilient skirt which is thicker than the web segment and thus has a greater elastic memory. The sidewall skirt stretches when forced over the protruding lip and then the skirt retracts radially inwardly closely adjacent to the outside wall of the container immediately below the lip to stretch the deformable web segment tightly over the lip to seal the mouth of the container.

One aspect of the invention relates to the container which is formed with an integral, outwardly projecting lip about the rim. The cross-section of the lip is contoured to provide a smoothly curving surface of enlarged diameter about which the deformable web of the lid sidewall can be wrapped. In another, modified form of the invention, the container rim is provided with an additional, inwardly projecting lip which cooperates with a sealing ring on the lid in a manner which enhances the seal. This latter configuration additionally provides enhanced hoop strength for the container itself as well as for the combined container and lid.

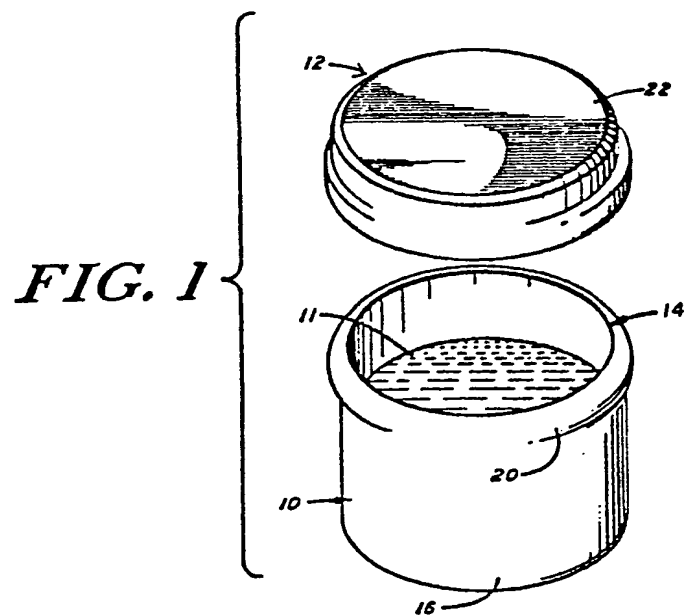
In one embodiment of the invention the lid sidewall is smooth and shoulderless on its interior surface to facilitate the fit of the sidewall over the lip of the container. One lid may be used with a variety of container lips having different sizes, shapes and compositions.

In another embodiment of the invention the lid sidewall is provided with a shoulder on its interior surface which, when the lid is in place, will be disposed below the lip and may engage the underside of the lip to provide an additional interlock between the lid and container. In this embodiment, which preferably is used in connection with the container having an additional inwardly projecting lip, the lid is provided with a sealing ring which engages the inwardly projecting lip of the container in a manner which tends to bias the lid upwardly. The upward bias tends to draw the shoulder on the lid sidewall snugly against the underside of the container outer lip. This configuration provides additional hoop strength for the assembled lid and container as well as providing a superior seal and safety configuration.

In a modification of the invention the lid is provided with a self contained compressible gasket which, when the lid is seated on the container, effects an additional which further supplements the integrity of the seal and assures hermetic characteristics.

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CONTAINER AND LID

This invention relates generally to container closures and more particularly to one-piece tightly fitting, molded plastic lids for use with containers having a protruding lip around the periphery of the mouth.

This application is a continuation-in-part of my prior application serial number 379,746 filed May 19, 1982 and entitled CONTAINER LID.

Containers with snap-fitting, removable lids often are formed with a mouth defined by a peripheral lip and a channel which together are intended to provide a suitable seal with an associated lid. In most such containers, the lid is applied to the container at the factory to create a satisfactory seal. However, the user often removes the lid with a prying tool, such as a screwdriver, especially if the lid is metal, and this action results in deformation of the container and/or the lid in a manner which may disrupt the formation of a cooperative seal when the lid is later replaced. Such deformation often makes it difficult or impossible to reseal satisfactorily the container utilizing the same lid. As a result, the contents of the container may deteriorate, either hardening or evaporating. Leakage of the contents from the container or leakage of water or other liquids into the container also can occur, either damaging the surface upon which the container is placed or rendering the contents unusable.

A lid which satisfactorily overcomes many of the problems attendant to poor resealing is described in my U.S. Patent 4,279,358. The lid described in that patent has an inwardly-facing shoulder formed on its depending sidewall which engages the underside of the protruding lip on the container. That lid is particularly suited for use with certain size and shape container lips, and precise placement of the inwardly-facing shoulder is desirable for optimum seating of the lid.

1           One aspect of the invention relates to a configuration  
for snap-fitting, one-piece, molded plastic lids which are  
modifications of the lid described in my U.S. patent  
4,279,358. Each lid configuration of this invention is  
5 adapted for use with a container having a laterally  
protruding peripheral lip, and is easily and inexpensively  
molded, easily removed and provides a tight and secure  
seal around the mouth of the container.

10           The lid includes a top wall and a sidewall which  
depends from the periphery of the top wall. The upper  
portion of the sidewall comprises a relatively thin,  
deformable web segment which is stretchable heightwise.  
The lower portion of the sidewall is contiguous with the  
upper portion and comprises a skirt having a greater  
15 radial thickness and greater elastic memory than the upper  
web portion.

20           The container preferably is molded and has a specially  
contoured rim extending about the container mouth. The  
rim includes an outer lip which extends radially outwardly  
away from the container sidewall. The outer lip is  
smoothly rounded along its outer upper sealing surface  
having a downwardly and outwardly sloping contour as it  
approaches the greatest diameter of the lip. The contour  
of the lip then extends inwardly toward the container  
25 sidewall at a sharper angle. The upper sealing surface of  
the lip cooperates with the stretchable web on the lid so  
that the web will wrap about the upper sealing surface to  
provide a seal.

30           In another aspect of the invention the container rim  
also may have an inner lip which extends radially inwardly  
from the inner surface of the container wall. The inner  
lip has a downwardly and inwardly sloping inner seating  
surface which cooperates with an inner sealing ring formed  
on the lid. In this embodiment of the invention the  
35 container rim is engaged both on the inside and the  
outside by the lid and in a manner which enhances the seal

1 while also providing substantially increased hoop strength  
for the container and lid individually and in combination.

5 In one embodiment of the lid, the inner surface of the  
lid sidewall of the container is smooth and free of  
interruptions, such as shoulders, along its height. The  
inner diameter of the lid sidewall is smaller than the  
outside diameter of the container lip and generally equal  
10 to the outside diameter of the container. In another  
embodiment of the lid, the sidewall is provided with a  
shoulder which, when the lid is seated on the container,  
will be disposed below the outer lip of the container to  
provided added resistance to inadvertent removal.

15 In still another embodiment of the invention the lid  
may be provided with a compressible ring of sealing  
material which is carried by the lid and which will engage  
the uppermost edge of the rim when the lid is seated.

20 In each embodiment of the invention, when the lid is  
applied to the container, the inner surface of the  
sidewall is advanced over the lip. Once the lower, skirt  
portion of the sidewall has advanced past the lip, its  
elastic memory causes it to contract radially inwardly  
toward the container sidewall thereby stretching the thin  
upper web segment of the sidewall around the lip of the  
container drawing the web into conformity with the shape  
25 of the lip. The contracted lower portion of the sidewall  
thereafter remains immediately below the lip, tensioning  
the upper web segment of the sidewall in engagement with  
the lip. The elasticity of the lower skirt portion of the  
sidewall maintains the seal and prevents the sidewall and  
10 the cover from riding up over the container lip.

15 The lid may be provided with an inner sealing band or  
ring which depends from the top wall and is adapted to  
seat against the inner surface of the container opening by  
the stretching of th lid sidewall over the container  
lip. The sealing band is molded integrally with the lid  
and is spaced radially inwardly from the lid sidewall.

1       The lid also may be provided with a plurality of  
reinforcing ribs extending radially inwardly from the  
sealing band.

5       The lid of this invention is reusable, without  
destroying its sealing capabilities, for the life of the  
elastic memory of the lower portion of the lid sidewall.

10       In the embodiment of the lid which has no internal  
shoulder, the smooth interior surface of the sidewall  
makes molding of the lid easy and fast and facilitates  
application and removal of the lid. In addition, precise  
dimensioning of the container lid to the lip is not  
required and greater tolerances are permitted in forming  
the lid since the lower portion of the sidewall is  
sufficiently flexible to allow it to seat about the lip  
15       even if the fit is not exact. Thus, with the shoulderless  
embodiment one lid may be used with a variety of container  
lips having different shapes, radial dimensions and formed  
of different materials.

20       In other embodiments of the lid, which utilize a  
shoulder on the inner surface of the lid sidewall, the  
cooperation between the lid and the container is such that  
the shoulder tends to become drawn upwardly into  
engagement with the underside of the outer lip of the  
container. Although the engagement of the shoulder with  
25       the underside of the lip does not itself provide the  
primary seal, it does lessen the chance of the cover  
becoming dislodged inadvertently. To that end, this  
embodiment of the lid incorporates a V-shaped inner ring  
which is spaced radially inwardly from the periphery of  
30       the lid. The outermost wall of the V-ring is spaced  
slightly from the stretchable web on the lid sidewall and  
cooperates with the web to define an annulus receptive to  
the container rim. The configuration of the outer wall of  
th V-ring and th web of the sidewall is such as to cause  
35       a pinching or squeezing of the upper rim of th container  
tending to bias the lid upwardly. The upward biasing

applied to the lid tends to draw the shoulder of the lid sidewall into engagement with the underside of the container outer lip. In addition the V-ring on the lid also enhances the hoop strength and distortion of the lid when it is apart from the container as well as when it is on the container. Still another advantage of this embodiment is that the V-ring provides for some flexibility in the lid which enables the lid to dome and flex without disrupting the seal between the web and container lip.

In a modification of the invention the lid may be provided with a compressible resilient gasket in the annulus which receives the container rim. The gasket is located and dimensioned with respect to the lid and rim so that it is compressed partially by the upper edge of the rim when the lid is on the container, thereby providing a supplemental and hermetic seal in addition to the primary seal effected by the cooperation between the web segment of the sidewall and the container outer lip.

It is among the general objects of the invention to provide improved containers, lids and cooperative sealing arrangements therefor. More particularly, it is among the general objects of the invention to provide containers and lids of the type described which may be of integral molded plastic construction yet which display superior sealing and security characteristics.

Another object of the invention is to provide a sealing system for a lid and container in which the integrity of the seal is not destroyed by repeated reuse of the lid and container.

The objects, advantages and features of this invention will be more clearly appreciated from the following detailed description taken in conjunction with the accompanying drawing in which:

FIG. 1 is a pictorial representation of a container and lid in accordance with the invention;

1           FIG. 2 is a partial sectional view of the container lid and container of FIG. 1 prior to application of the lid;

5           FIG. 3 is a partial sectional view of the lid and container of FIG. 2 after application of the lid to the container;

          FIG. 4 shows an alternative embodiment of the container of FIGS. 1-3;

          FIG. 5 shows an alternative embodiment of the container lip of the container of FIGS. 1-2;

10          FIG. 6 is a cutaway pictorial representation of one embodiment of the lid of this invention.

          FIG. 7 is a pictorial representation of a container and lid in accordance with the modified embodiment of the invention;

15          FIG. 8 is a partial sectional view of the container lid and container as shown in FIG. 7 prior to application of the lid and arranged to illustrate the relative diameters of the operative lid and container elements;

20          FIG. 9 is a partial sectional view of the lid and container of FIG. 8 after application of the lid to the container;

          FIG. 10 is an illustration of the modified form of the lid incorporating a compressible gasket to effect a supplemental seal;

25          FIG. 11 is an illustration of the lid shown in FIG. 10 applied under full pressure to the container; and

          FIG. 12 is an illustration of the lid and container of FIG. 10 with the applying pressure relaxed and illustrating the retention of the supplemental seal.

30          FIGS. 1-3 illustrate one embodiment of each of an exemplary container 10 and lid 12 incorporating an aspect of this invention. Container 10 typically has a generally cylindrical shape and the upper end of the container 10 is provided with a mouth 11 which extends generally across  
35          the entire diameter of the container. Mouth 11 is bounded



by a rim 14 region at the upper end of container sidewall 16 which may be formed integrally with or formed as a separate piece and secured to the upper end of sidewall 16. A surface 18 is formed at the rim region 14 on the inwardly facing side of the sidewall 16 and outer lip 20 is disposed on the outwardly facing side of the rim region 14. Lip 20 projects radially outwardly away from sidewall 16 of the container and extends around the entire periphery of mouth 11. Lip 20 preferably is smoothly rounded along its entire outer surface and is formed to define an upper seal surface 21 which slopes downwardly away from the top of the rim 14 until the point of greatest radial extent is reached (indicated at 23 in FIG. 2) after which it curves more abruptly inwardly along a lower seal surface 25 toward sidewall 16. Lip 20 may be molded with sidewall 16 or formed separately and attached integrally thereto.

In each embodiment of the invention the lid 12 is molded as a unitary piece and includes a top wall 22 and a sidewall 24 which depends downwardly from the periphery of top wall 22. Sidewall 24 is formed of two segments, an upper web segment 26 adjacent top wall 22 and a lower segment or skirt 28 spaced from top wall 22. In the embodiment shown in FIGS. 1-3 the inner diameters of skirt 28 and web segment 26 are substantially equal so that the inner surface of sidewall 24 is smooth and uninterrupted. The inner diameter of sidewall 24 is generally equal to outside diameter of container sidewall 16 and is less than the outside diameter of lip 20. Web segment 26 is relatively thin and is deformable in a heightwise or axial direction. Skirt 28 is substantially thicker than web segment 26, is not deformable in a heightwise direction, and possesses a much greater elastic memory. Both skirt 28 and web segment 26 are expandable in a radial direction. The lower edge of skirt 28 may be bevelled or smoothly curved as indicated at 30 to facilitate the

radial expansion of sidewall 24 as it is urged over the circumferential lip 20.

As shown in FIGS. 2 and 3, lid 12 is applied to container 10 by press-fitting it over rim 14. As the bevelled or smoothly curved lower edge 30 of lid sidewall 24 is urged downwardly against lip 20 of the container, the relatively thick skirt 28 is forced radially outwardly to expand as the lid is urged progressively downwardly onto the container. When skirt 28 has been advanced beneath lip 20, the elastic memory of the skirt 28 causes it to snap back to its original configuration and constrict radially inwardly about the container sidewall 16 until it seats against sidewall 16 beneath lip 20 as shown in FIG. 3. This elastic constricting force of skirt 28 causes web segment 26 to be stretched heightwise. When fully seated web segment 26 is in a thinner stretched configuration and is tightly and intimately wrapped about lip 20 causing web segment 26 to conform closely to the exterior shape of lip 20 to form a continuous seal. The heightwise stretching of web segment 26 over and around lip 20 by skirt 28 effectively inhibits lid 12 from rising upwardly and off container 10 and seals mouth 11.

As shown in FIGS. 2 and 3, lid 12 also may be provided with a sealing ring 32 which is usually molded integrally with the lid. Sealing ring 32 depends downwardly from the underside of top wall 22, is spaced radially inwardly from the outer perimeter of lid 12, and extends continuously around the lid parallel with the perimeter thereof. Sealing ring 32 is dimensioned so that it seats against surface 18 of container rim 14 when sidewall 24 is urged downwardly and stretched over lip 20. No channel is required in rim 14 for proper seating of ring 32, since the tight fit of sidewall 24 over lip 20 is sufficient to seat ring 32 against surface 18 and to seal mouth 11. The lack of such a channel prevents the accumulation of fluids between ring 32 and surface 18 which can prevent

1       th formation of a good seal and permits all fluids to  
drip back into the container.

5       In a modification of the foregoing embodiment shown in  
Fig. 6, lid 12 may be provided with a plurality of  
radially extending ribs 39 on the underside of top wall  
22. Ribs 39 typically extend from sealing ring 32  
inwardly to another ring 37 radially spaced from ring 32  
and concentric therewith. Ribs 39 are equally spaced in a  
10       circumferential direction about rings 32 and 37 and  
preferably decrease gradually in thickness normal to top  
wall 22 moving from ring 32 to ring 37. Thus, the lower  
radially extending surface of each rib 39 rises upward  
toward top wall 22 going from ring 32 to ring 37 to  
15       provide each rib with a trapezoidal cross-sectional  
shape. Ribs 39 reinforce top wall 22 and prevent top wall  
22 from being deformed radially inwardly or outwardly and  
they help preserve the seal between lid 12 and mouth 11.  
Ring 32 also prevents radial deformation of lid 12, thus  
20       providing a more secure seal, especially in impact  
situations, by maintaining the circular shape of lid 12.  
Ribs 39 maintain the flat configuration of top wall 22 and  
prevent it from warping, thus minimizing splaying of  
sidewall 24 and providing a secure seal. Ribs 39 and  
rings 32 and 37 are formed of the same material as the lid  
25       and add little extra weight thereto.

Alternative embodiments of the container and lid  
configurations are shown in FIGS. 4 and 5. Since the  
containers and lids illustrated in FIGS. 4 and 5 are  
30       identical in some general respects to those of FIGS. 1-3,  
like numbers are used for like parts for convenience. In  
FIG. 4, exterior sidewall 16 of container 10 is provided  
with an indentation 50 formed immediately below lip 20.  
In this embodiment the inner diameter of skirt 28 is  
35       slightly less than that of the outside diameter of  
container sidewall 16, so that as skirt 28 is forced over  
lip 20, its elastic memory causes skirt 28 to retract

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1 sufficiently to reside within indentation 50. Indentation  
50 conforms to the shape of the inner wall of skirt 28 in  
its seated condition, so that skirt 28 seats securely and  
tightly within indentation 50. This seating of skirt 28  
5 within indentation 50 produces a greater heightwise  
stretching of web segment 26, thereby providing a tighter  
fit of lid 12 on container 10 and providing a more secure  
seal.

FIG. 5 illustrates the application of this invention  
10 to a container having a lip 52 similar in shape and  
dimension to that found on conventional metal, wide-mouth  
paint containers. Lip 52 is provided with a less rounded,  
more sharply angled, top and undersurface than lip 20 and  
is also provided with a lesser radial dimension with  
15 respect to the container sidewall. Typically, the radial  
dimension of lip 52 measured in its protrusion from  
container sidewall 16 is about one-half as great as that  
of the type of lip illustrated at 20 in FIGS. 1-4.

The lid and container of this invention have several  
20 advantages over the lid and container as described in U.S.  
patent 4,279,358. As to the lid, omission of the inwardly  
facing shoulder on the inner surface of sidewall 24,  
enables the foregoing embodiment of the lid to be molded  
more easily, faster and less expensively. As to the  
25 container, lip 20 has a much greater radial dimension  
which provides a much larger and better shaped surface  
over which web segment 26 may contact the lip 20. That  
causes a greater stretching force of web segment 26 with  
resulting greater surface area of the sidewall which wraps  
30 about the lip 20. The more rounded configuration of lip  
20 allows web segment 26 to conform more closely to the  
shape of the lip. The rounded configuration of lip 20  
also facilitates both the removal and the application of  
lid 12 to container 10. The greater extent of wrap of web  
35 segment 26 around lip 20 and the greater radial dimension  
of lip 20 also ensures that the lid will not inadvertently

1 pop off the container. The greater chord length and  
greater stretching of web segment 26 allows the container  
to accommodate variations in web segment 26 or improper  
seating of ring 32 against surface 18 without breaking the  
5 seal between the container and the lid.

The absence of an inwardly facing shoulder facilitates  
application and removal of the lid from the container.  
The degree of curvature which may be imparted to the lip  
is in part a function of the degree of flexibility and  
10 elasticity of the material used for the lid. The softer  
or more flexible the lid material, the more it will bend  
and the sharper the curve formed by the lip may be and the  
greater its permissible radial extent. A stiffer material  
will require a more gentle slope or curve on the underside  
15 of the lip than a lip with a lesser radial extent.

The amount of stretch that may be imparted to the web  
segment and the amount of snap the skirt possesses as it  
is pushed over the lip during application of the lid is a  
function of the elastic memory of the skirt which in turn  
20 is proportional to the skirt thickness. It also is a  
function of the strength of the skirt relative to the web  
segment. If a greater elastic memory or a greater  
strength or a tighter seal is desired the skirt may be  
provided with a greater radial thickness. The seal may be  
25 improved further by providing the skirt with an inside  
diameter a few thousandths of an inch less than the  
outside diameter of sidewalls 16 of the container. In  
this manner, the skirt will snap back against the  
container sidewall more quickly and bear against the  
30 container sidewall with greater force, providing a tighter  
seal by more tightly stretching the web segment over the  
lip.

By way of example only, the dimensions of a container  
and lid described in the foregoing embodiments of this  
35 invention are set forth. It is to be understood, that by  
providing such examples, the scope of the invention is in

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1 no way limited. Thus, top wall 22 of lid 12 may have a  
thickness of 0.05 inches; lip 20 extends radially  
outwardly a maximum distance of 0.145 inches from the  
inside wall of container 10; the radius of curvature of  
5 lip 20 at its maximum radial extent is .05 inches; lip 20  
has an axial extent of about .25 inches; web segment 26  
has a radial thickness of 0.015 inches; skirt 28 has a  
radial thickness of 0.06 inches or about one half the  
thickness of lip 20, and extends outwardly a distance of  
10 0.045 inches from the exterior surface of web segment 26;  
skirt 28 has a heightwise dimension of approximately 0.125  
inches; the entire heightwise dimension of the sidewall 24  
is approximately 0.265 inches; and the heightwise  
dimension of web segment 26 alone is 0.14 inches.

15 Typically, the lid of this invention is formed of a  
low density polyethylene, although other suitably elastic  
materials may be used.

Container 10, although shown as being cylindrical, may  
be a cube, a parallelopiped or any other desired shape.  
20 Mouth 11 may be formed as shown or formed on an axially  
extending neck with a cross-sectional dimension less than  
that of container 10.

FIGS. 7-13 illustrate additional embodiments and  
modifications of lids and containers in accordance with  
the present invention. In the embodiment of the container  
25 shown in FIGS. 7-9 the rim region 14 of the container  
includes an inner lip 60 in addition to the outer lip 62.  
The inner lip projects radially inwardly from the  
container sidewall 64. The inner lip 60 has a downwardly  
and inwardly sloping surface 66 which serves as an inner  
30 seat in cooperation with a V-ring formed on the lid, as  
will be described. The lower region of the inner lip 60  
may slope downwardly and outwardly, as indicated at 68, to  
merge smoothly with the inner surface of the container  
35 wall 64. The inner lip may extend downwardly along the  
container wall to a greater extent than does the outer lip

1        62. The inner lip 60 serves to add substantial hoop  
strength to the container, particularly when the container  
is held by a bail. Preferably the thickness of the rim is  
at least substantially equal to or greater than the  
5        thickness of the container sidewall. It also cooperates  
with the shape of the outer lip and the configuration of  
the lid in a manner which facilitates placement of the lid  
on the container.

10        The outer lip 62 has the upper seal surface 70 which,  
as shown, extends in a smooth curve from the upper edge 72  
of the rim downwardly and radially outwardly. In the  
embodiment shown in FIGS. 7-9 the outer lip 62 terminates  
in a relatively flat, downwardly facing horizontal ledge  
74.

15        The lid illustrated in FIGS. 7-9 is of molded plastic  
construction and includes a top wall 76 and a surrounding  
sidewall 78 which extends downwardly from the top wall.  
As with the previously described embodiment, sidewall 78  
includes two segments, an upper web segment 80 and a lower  
20        skirt segment 82. The skirt segment 82 is considerably  
thicker than the web segment 80 and has a greater elastic  
memory. The relatively thinner web segment 80 is more  
easily stretched and can be wrapped about the outer lip 62  
of the container.

25        The embodiment of the lid shown in FIGS. 7-9 has a  
shoulder 84 formed at the inwardly facing surface of the  
sidewall 78. As shown, the shoulder 84 may define the  
transition between the web segment 80 and skirt segment  
82. The shoulder 84 should be located along the sidewall  
30        78 so that when the lid is pressed onto the container the  
shoulder 84 can be advanced downwardly about the outer lip  
62 to a location below the underside of the outer lip, as  
defined by ledge 74. As will be described in further  
detail the shoulder 84 cooperates with the underside 74 of  
35        the outer lip 62 to provide an interlock and assure that  
the lid will not be dislodged inadvertently except when

1 its removal is specifically intended. As described in  
connection with the previous embodiments the relative  
diameters of the outer lip 62 and web section 80 of the  
lid sidewall are such that when the web segment 80 is  
5 disposed about the outer lip 62 it will wrap about the  
outer lip in somewhat of a stretched configuration. Thus,  
the inner diameter of the web segment 80 is smaller than  
the outer diameter of the outer lip 62. Additionally the  
inner diameter defined by the skirt segment 82 of the lid  
10 is no greater than the outer diameter of the container  
sidewall and preferably may be slightly smaller to provide  
an enhanced constricting effect.

The lid also includes annular V-ring 86 which is  
formed integrally with top wall 76 of the lid and is  
15 located radially inwardly of the sidewall 78. The V-ring  
86 includes an inner wall 88 which slopes downwardly and  
radially outwardly, and an outer wall 90 which slopes  
upwardly and outwardly. The V-ring outer wall 90  
generally conforms to the slope of the inner seat 66 on  
20 the inner lip 60. The inner and outer walls 88, 90 are  
joined at a transition region 92 defined at a bight  
between the walls 88, 90. The upper end of the outer wall  
90 merges into an annular connecting wall 94. As shown in  
FIG. 8 the sidewall 78 extends from the outer extremity of  
25 the connecting wall 94. Thus, the outer wall 90 of the  
V-ring 86, the connecting wall 94 and sidewall 78 define  
an annular channel 96 which is receptive to the rim of the  
container as illustrated in FIGS. 9 and 10 and as will be  
described. The annular channel 96 is generally tapered  
30 from a wider region at its lower end to a more narrow  
region at its upper end, at the connecting wall 90. The  
lower region of channel 96 defines a channel entry annulus  
indicated at the arrow 98 which defines the region through  
which the container lip enters into the channel 96. The  
35 entry annulus 98 extends between the outer surface of  
V-ring outer wall 90 and the closest point on the interior



1 of the sidewall 78 which, as shown, is the inner surface  
of the shoulder region. In the preferred embodiment the  
entry annulus 98 is smaller than the corresponding  
radially measured thickness of the lipped container rim.  
5 When the lid is fitted onto the container the sidewall 78,  
including its web and skirt segments 80, 82, as well as  
the V-ring outer wall 90 flex so as to receive the lipped  
rim of the container. The lid components flex so as to  
enlarge the channel entry annulus 98. In this regard it  
10 should be noted that the generally upwardly tapering  
cross-sectional shape of the container rim, as defined by  
the inner lip 60 and/or outer lip 62 forms a generally  
wedge shape which facilitates progressive enlargement of  
the channel entry annulus 98 and smoothly and temporarily  
15 distorting the V-ring outer wall 90 and sidewall 78.

FIG. 9 illustrates the lid and container of FIG. 8 in  
a seated, interlocked and sealed configuration. As  
illustrated, the web segment 80 has a significant portion  
which wraps about the outer lip in snug conformity and  
20 contact with a significant portion of the upper sealing  
surface 70. FIG. 9 illustrates the region of snug  
wrapping contact along a band indicated generally by the  
region 100. As described previously in connection with  
other embodiments of the invention, the constricting force  
25 of the skirt segment 82 secures the skirt 82 about the  
container sidewall, below the outer lip 62 to maintain the  
web segment 80 in its wrapped, sealed relation about the  
outer lip 62.

It should be noted that a high degree of effective  
30 sealing may be obtained without requiring full wrapping  
contact of the web segment about the full outer surface of  
the outer lip 62. By providing a band along which the  
seal is made, substantially greater seal surface contact  
is made than is the case with most containers which, at  
35 best, provide little more than a sealing line rather than  
a distinct band.

1           Among the further advantages of the invention is that  
the lid and container lip may be molded with a relatively  
wide range of tolerances without adversely affecting the  
quality and effectiveness of the seal. Thus, as can be  
5       seen from FIGS. 9 and 10 the annular channel 96 may be  
dimensioned to have a vertical height somewhat greater  
than the vertical height of the outer lip 62. When the  
lid is on the container, as shown in FIG. 9, the  
connecting wall 94 may be spaced somewhat from the upper  
10      edge 72 of the rim thereby leaving the uppermost region of  
annular channel 96 unoccupied. The additional unoccupied  
region of annular channel 96 provides for a certain amount  
of tolerance between the lid and container. When the lid  
is fitted onto the container the skirt and web segments  
15      will assume the configuration illustrated in FIG. 9 thus  
effecting the seal. By providing the additional vertical  
height to the annular channel 96 the precise location of  
the shoulder is less critical. This may be seen from FIG.  
10      10 which illustrates the container and lid of FIG. 9 but  
with the lid pressed down more forcefully over the  
container rim. Although, as shown in FIG. 10, that causes  
the shoulder to separate somewhat from the bottom of the  
outer lip 62, the sealing bands 100 still is maintained.  
Thus, the skirt continues to maintain its constricting  
25      effect which continues to cause the wrapped sealed  
configuration of the web about the outer lip. Thus, the  
foregoing configuration assures that an effective seal  
will be made and will not be disrupted even if the lid and  
container are subjected to rough handling.

30           It may be noted from FIG. 10 that the sealing band 100  
has shifted somewhat from its relative location  
illustrated in FIG. 9. That results from a tendency of  
web segment 80 and V-ring outer wall 92 to be further  
wedged apart by the generally wedged shape of the  
35      container rim. In this regard it should be noted that the  
taper of the annular channel 96 preferably is somewhat

1 less than the general wedge or taper defined by the rim of  
the container. As the parts are progressively mated the  
generally wider wedge defined by the rim will tend to  
5 spread apart the relatively narrower wedge defined by the  
annular channel 96. This has been found to tend to cause  
the sealing band 100 to shift positions more upwardly  
along the upper sealing surface 76. The seal is not  
disrupted or broken but, instead, is merely shifted  
10 thereby enabling the container and lid to be subjected to  
varying loads and a wide variety of conditions which,  
instead of breaking a seal, merely shift it to a different  
but continuous location.

It also should be noted that the relative sizes of the  
wedge on the container rim and the wedge defined by the  
15 annular channel also are such as to cause the lid and  
container to tend to assume the configuration shown in  
FIG. 9. Thus, even if the lid is forced down to the  
position shown in FIG. 10, when released the V-ring outer  
wall 90 will tend to re-expand somewhat and in cooperation  
20 with the web segment 80, will tend to pinch the wedge-like  
rim to tend to cause the lid to rise upwardly. That, in  
turn, tends to draw the lid to the configuration shown in  
FIG. 9 in which the shoulder is in proximity to or engaged  
with the ledge 74 thereby preventing further rise of the  
25 lid.

The V-ring, and particularly its outer wall 90,  
maintains contact with the inner seat 66 of the inner lip  
60. Although that does provide an additional sealing  
region, the primary seal of the invention is effected  
30 along the band contact between the web segment and the  
outer lip. The cooperation between V-ring outer wall 90  
and inner seat 66, however, serves to substantially  
increase the hoop strength of the combined container and  
lid. That is a particularly important advantage when the  
35 container is used in environments where rough handling may  
be expected, such as with paint cans.

1           FIGS. 11-13 illustrate another modification to th  
invention in which a supplemental seal is included. In  
.. this embodiment a resilient compressible gasket 102 is  
located along the upper region of the annular channel 96.  
5       The gasket 102 may be formed from a foam plastic material  
which may be in the form of a foam plastic O-ring or which  
may be extruded directly into the upper region of the  
annular channel 96. The gasket 102, annular channel 96  
and container rim are of a configuration such that when  
10       the lid is in its normal secured position on the  
container, such as the configuration shown in FIG. 9 and  
illustrated again in FIG. 13, the gasket 102 will be  
partially compressed against the upper edge 72 of the  
rim. As shown in FIG. 12, the gasket also should be  
15       compressible even further such as when the lid is forced  
down fully over the container, as described above in  
connection with FIG. 10.

          Thus, I have defined my invention and its various  
aspects and embodiments. It should be understood,  
20       however, that the foregoing descriptions of the invention  
are intended merely to be illustrative thereof and that  
other embodiments and modifications may be apparent to  
those skilled in the art without departing from its spirit.

          Having thus described the invention what I desire to  
25       claim and secure by letters patent is:

CLAIMS

1           1.    A lid for a container having a sidewall, a mouth  
2 disposed at the upper end of the sidewall, and a lip  
3 extending about the periphery of the container mouth, said  
4 lid comprising:

5           a top wall;

6           a relatively thin resilient sidewall web segment  
7 depending downwardly from said top wall and being  
8 stretchable heightwise and expandable radially; and

9           a skirt integral with and extending downwardly from  
10 the lower edge of said web segment, said skirt being  
11 thicker than said web segment and displaying a greater  
12 resistance to radial and heightwise expansion and greater  
13 elastic memory than said web segment;

14           the inner diameter of said web segment being no more  
15 than the inner diameter of said skirt, the inner surfaces  
16 of said skirt and said web segment forming a continuous  
17 and uninterrupted inner sidewall surface;

18           said web segment being stretchable heightwise to  
19 enable it to wrap snugly and sealingly around the outer  
20 surface of said container lip when said lid is applied to  
21 said container, said skirt being constructed to retain the  
22 stretched web segment in sealing engagement with said  
23 container lip when said lid is applied to said container  
24 mouth with said skirt against said container sidewall.

1           2.    A lid as defined in claim 1 wherein the inner  
2 diameter of said skirt is substantially equal to the outer  
3 diameter of said container sidewall.

1           3.    A lid as defined in claim 2 formed from low to  
2 medium density polyethylene, said web segment being of the  
3 order of 0.015 inches thick and said skirt being of at  
4 least 0.06 inches thick.

1           4.    A lid as defined in claim 1 wherein said lid  
2 further comprises a sealing ring molded integrally with

3 and depending from the underside of said lid, said sealing  
4 ring being dimensioned to seat against an interior surface  
5 of said container mouth.

1 5. A lid as defined in claim 1 wherein said inner  
2 sidewall surface is a generally cylindrical surface.

1 6. A lid as defined in claim 5 wherein said inner  
2 sidewall surface is a right cylindrical surface.

1 7. Apparatus for sealing a wide mouth container with  
2 a lid comprising, in combination:

3 a container sidewall, the upper end thereof defining  
4 the boundary of said container mouth:

5 an outwardly protruding lip at the upper end of said  
6 container sidewall and extending around the entire  
7 perimeter of the container mouth;

8 said lid having a top wall and a lid sidewall secured  
9 to and depending downwardly from the periphery of said top  
10 wall of said lid, said lid sidewall having a smooth,  
11 shoulderless inner surface facing said container sidewall,  
12 said lid sidewall comprising:

13 a thin, elastic web segment stretchable in a  
14 heightwise direction; and

15 a lower skirt portion formed integrally with and  
16 disposed below said web segment, said skirt  
17 having a thickness and resistance to heightwise  
18 and radial stretching greater than said web  
19 segment, said skirt having a lower portion  
20 adapted to be forced over said lip of said  
21 container;

22 said lid being adapted to be snap-fitted over said  
23 container mouth by forcing said sidewall over said lip of  
24 said container, to expand said skirt radially outwardly,  
25 said skirt being adapted to contract radially inwardly  
26 toward said container sidewall after passage over said lip  
27 to stretch said web segment heightwise and to deform said  
28 web segment to cause said web segment to closely conform  
29 to the shape of said lip and to wrap sealingly around the

-21-

30 outer surface of said lip, said skirt being contracted  
31 below the lip to retain said web segment in sealing  
32 engagement with said container lip.

1 8. Apparatus as defined in claim 7 further  
2 comprising a depression disposed immediately below said  
3 container lip in said container sidewall for seating of  
4 said skirt therein.

1 9. Apparatus as defined in claim 7 wherein the  
2 underside of said lip facing away from the mouth of said  
3 container has a sharply angular cross-sectional profile.

1 10. Apparatus as defined in claim 7 wherein said lip  
2 is provided with a smoothly curved cross-sectional profile  
3 and slopes downwardly away from said container mouth, said  
4 lip extending outwardly away from said container sidewall  
5 a distance at least twice as great as the thickness of  
6 said skirt.

1 11. Apparatus as defined in claim 7 further  
2 comprising a sealing ring molded integrally with and  
3 depending from the underside of said lid, said sealing  
4 ring being adapted to seat against an interior surface of  
5 said container mouth when said lid is fitted onto said  
6 mouth of said container.

1 12. Apparatus as defined in claim 7 or 11 further  
2 comprising radially extending ribs formed on a bottom wall  
3 of said lid.

1 13. Apparatus as defined in claim 7 wherein the lower  
2 portion of the skirt is rounded.

1 14. In a container having a sidewall and a rim at the  
2 upper end of the sidewall, the rim defining the mouth of  
3 the container, an improved rim construction comprising:

4 said rim being formed integrally with the container  
5 sidewall, the rim having an upper edge and an outer lip  
6 which extends radially outwardly, the outer lip having a  
7 maximum diameter;

8 the outer lip having an upper sealing surface which  
9 extends downwardly and outwardly from the upper edge of

10 th rim to the maximum diameter of th outer lip;

11 said lip having a lower surface which extends from the  
12 maximum diameter to the container sidewall, said lower  
13 surface defining a sharper, more abrupt transition back  
14 toward the sidewall than that defined by the upper sealing  
15 surface.

1 15. A container as defined in claim 14 wherein the  
2 upper sealing surface of the outer lip progressively  
3 enlarges in diameter as it extends downwardly and  
4 outwardly from the upper edge of the rim to the maximum  
5 diameter of the outer lip.

1 16. A container as defined in claim 15 wherein the  
2 upper sealing surface is curved in a downwardly and  
3 outwardly convex configuration.

1 17. A container as defined in claim 16 wherein the  
2 lower surface merges smoothly with the container sidewall  
3 and with the upper seal surface.

1 18. A container as defined in claim 16 wherein the  
2 lower seal surface is substantially flat and makes a sharp  
3 angular transition at its juncture with the maximum  
4 diameter of the lip and at its juncture with the container  
5 sidewall.

1 19. A container as defined in claim 14 further  
2 comprising:

3 the rim having an inner lip which extends downwardly  
4 and inwardly from the upper edge of the rim to define a  
5 downwardly and inwardly sloping surface;

6 said inner and outer lips defining a thickened rim.

1 20. A container as defined in claim 19 wherein the  
2 combined thickness of the inner and outer lips is  
3 substantially equal to at least twice the thickness of the  
4 sidewall of the container.

1 21. A container as defined in claim 19 further  
2 comprising:

3 said inner lip defining a minimum diameter which is  
4 smaller than the inside diameter of the container wall,



5 the lip having a lower surface which extends outwardly  
6 from the minimum diameter and which merges with the inner  
7 surface of the container wall.

1 22. A container as defined in claim 21 wherein the  
2 transition of the inner lip is at a less sharp angle than  
3 the transition of the lower surface of the outer lip.

1 23. A container as defined in claim 19 wherein the  
2 upper seal surface is curved smoothly and extends in a  
3 downwardly and outwardly direction.

1 24. A lid for a container having a sidewall, a mouth  
2 disposed at the upper end of the sidewall, and the lip  
3 extending about the periphery of the container mouth, said  
4 lid comprising:

5 a top wall;

6 a relatively thin resilient sidewall web segment  
7 depending downwardly from said top wall and being  
8 stretchable heightwise and expandable radially;

9 a skirt integral with and extending downwardly from  
10 the lower edge of said web segment, said skirt being  
11 thicker than said web segment and displaying a greater  
12 resistance to radial and heightwise expansion and a  
13 greater elastic memory than said web segment;

14 said web segment being stretchable heightwise to  
15 enable it to wrap snugly and sealingly around the outer  
16 surface of said container lip when said lid is applied to  
17 said container, said skirt being constructed to retain the  
18 stretched web segment in sealing engagement with said  
19 container lip when said lid is applied to said container;

20 the lid having a seating ring formed therein and  
21 extending downwardly from the top wall radially inwardly  
22 of the sidewall, the seating ring having an outwardly  
23 facing surface which cooperates with the inwardly facing  
24 surface of the sidewall to define a channel receptive to  
25 the container rim, said channel having a width which is  
26 less than the thickness of the rim at the point of maximum  
27 diameter of the rim;

the diameter  $d$  find by the web segment being less than the outer diameter of the rim whereby when the container lid is advanced onto the container rim, the web segment of the lid will be wrapped at least partly about the rim to form a band of sealing contact between the web segment and the lip.

25. A lid as defined in claim 24 further comprising a shoulder formed at the inner surface of the sidewall and being adapted to engage the underside of the lip.

26. A container lid as defined in claim 24 wherein said seating ring further comprises:

a V-shaped ring formed integrally with and extending downwardly from the top wall, the V-shaped ring having an outer wall which faces and defines said channel, the slope of the V-ring outer wall being downwardly and inwardly so as to define a wedge-shaped channel.

27. A lid as defined in claim 26 further comprising a shoulder formed at the inner surface of the sidewall and being adapted to engage the underside of the lip.

28. A lid as defined in claim 26 wherein the angle of the wedge shaped channel in the lid is less than the wedge angle defined by the container rim.

29. A lid as defined in claim 24 further comprising a compressible gasket disposed at the upper end of the lid channel to engage the upper edge of the rim and being constructed and arranged as to effect a supplemental seal.

30. In a container and lid therefor, the container having a sidewall and a rim at the upper end of the sidewall, the rim defining a wide mouth for the container, said apparatus comprising, in combination:

said rim being formed integrally with the container sidewall, the rim having an upper edge and an outer lip which extends radially outwardly, the outer lip having a maximum diameter;

the outer lip having an upper sealing surface which extends downwardly and outwardly from the upper edge of

11 the rim to the maximum diameter of the outer lip;

12 said lip having a lower surface which extends from the  
13 maximum diameter to the container sidewall; said lower  
14 surface defining a sharper, more abrupt transition back  
15 toward the sidewall then defined by the upper sealing  
16 surface;

17 said lid including a top wall and a sidewall extending  
18 downwardly from the periphery of the lid;

19 said sidewall including a relatively thin resilient  
20 sidewall web segment depending downwardly from said top  
21 wall and being stretchable heightwise and expandable  
22 radially;

23 a skirt integral with and extending downwardly from  
24 the lower region of said web segment, said skirt being  
25 thicker than said web segment and displaying a greater  
26 resistance to radial and heightwise expansion and a  
27 greater elastic memory than said web segment;

28 said web segment being stretchable heightwise to  
29 enable it to wrap snugly and sealingly around the upper  
30 sealing surface of said container lip when said lid is  
31 applied to said container, said skirt being constructed to  
32 retain the stretched web segment in sealing engagement  
33 with said container lip when said lid is applied to said  
34 container;

35 the diameter defined by the web segment being less  
36 than the outer diameter of the lip whereby when the  
37 container lid is advanced out to the container rim, the  
38 web segment of the lid will be wrapped at least partly  
39 about the rim to form a band of sealing contact between  
40 the web segment and the upper sealing surface of the lip.

1 31. A container and lid as defined in claim 30  
2 further comprising:

3 the container rim having an inner lip which extends  
4 downwardly and inwardly from the upper edge of the rim to  
5 define a downwardly and inwardly sloping surface;

6 said lid further comprising a V-shaped ring formed

7 integrally with and extending downwardly from the lid top  
8 wall, the V-shaped ring having an outer wall which slopes  
9 downwardly and inwardly so as to substantially correspond  
10 to the downwardly and inwardly inclined slope of the inner  
11 lip;

12 said V-ring and container inner lip being constructed  
13 and arranged as to mate with each other when the lid is in  
14 place on the container.

1 32. Apparatus as defined in claim 31 further  
2 comprising:

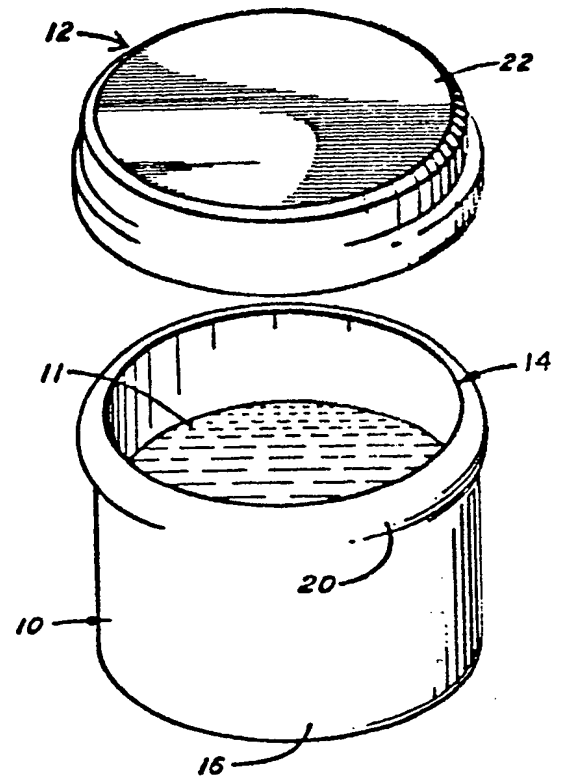
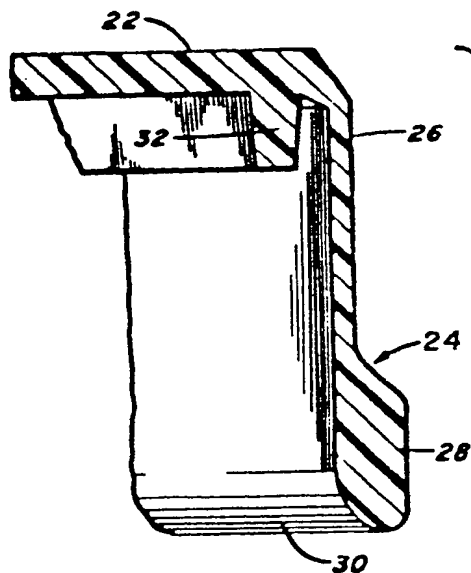
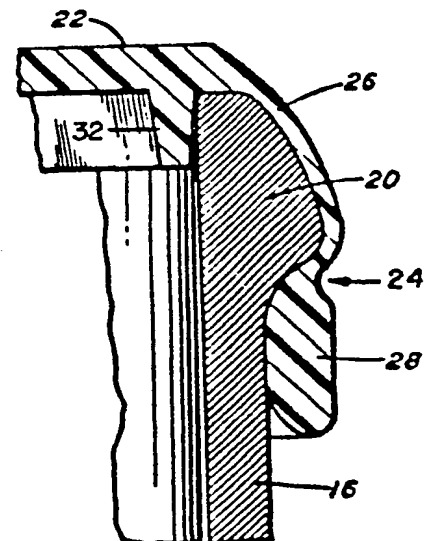
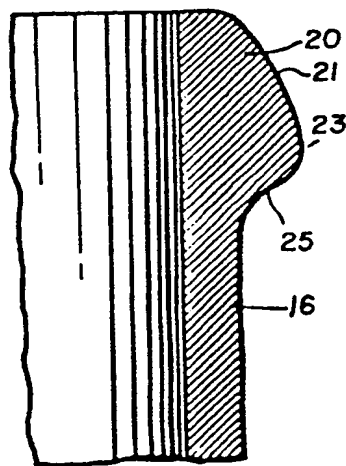
3 a shoulder formed at the inner surface of the sidewall  
4 and being adapted to engage the underside of the outer lip.

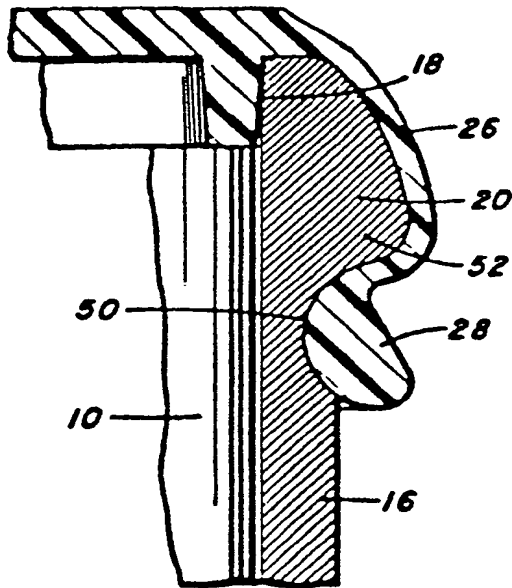
1 33. Apparatus as defined in claim 31 wherein the  
2 outer wall of the V-shaped ring and the lid sidewall  
3 define a channel receptive to the container rim;

4 a compressible gasket disposed within the lid channel  
5 and located to engage the upper edge of the rim when the  
6 rim is inserted into the channel, the gasket being  
7 constructed and arranged as to effect a supplemental seal  
8 against the upper edge of the rim.

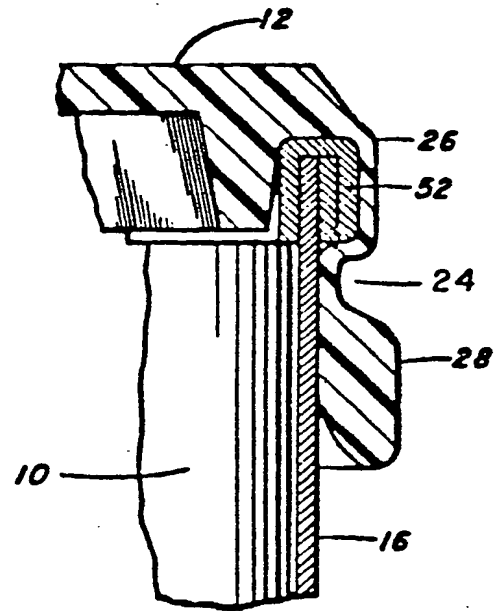
1 34. Apparatus as defined in claim 31 wherein the  
2 outer wall of the V-shaped ring and the lid sidewall  
3 define a wedge-shaped channel;

4 the container rim being wedge-shaped in cross-section;  
5 the wedge angle defined by the wedge-shaped channel in  
6 the lid being less than the wedge angle defined by the  
7 container rim.

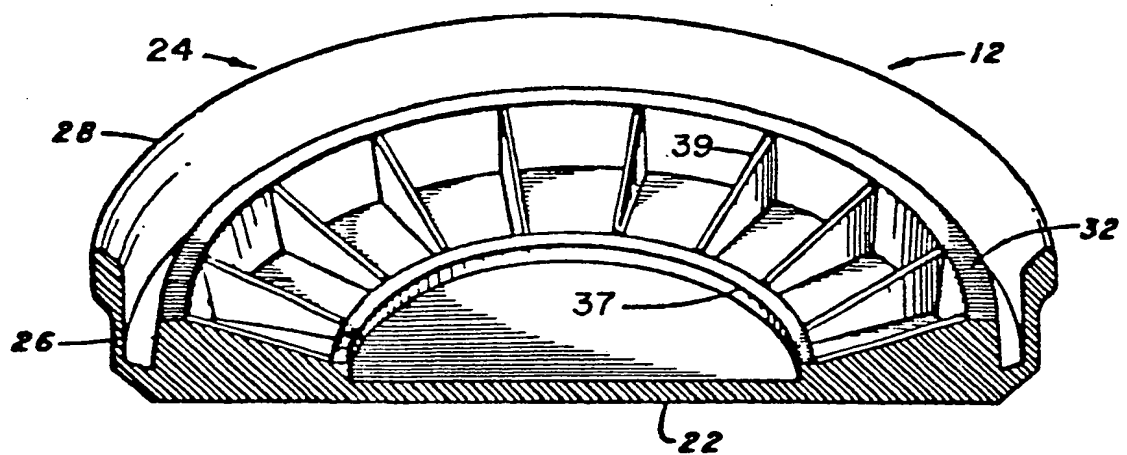
*FIG. 1**FIG. 2**FIG. 3*



**FIG. 4**

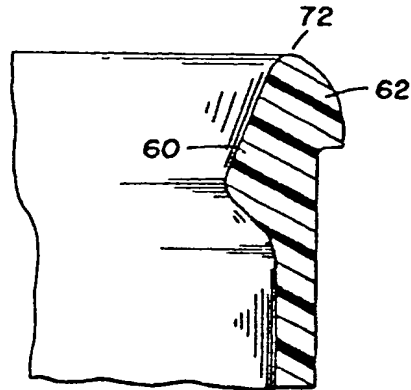
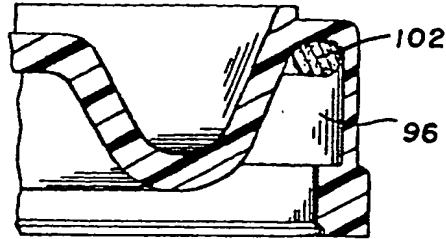


**FIG. 5**

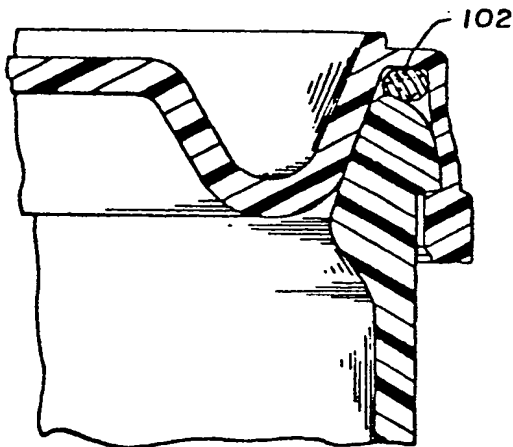


**FIG. 6**

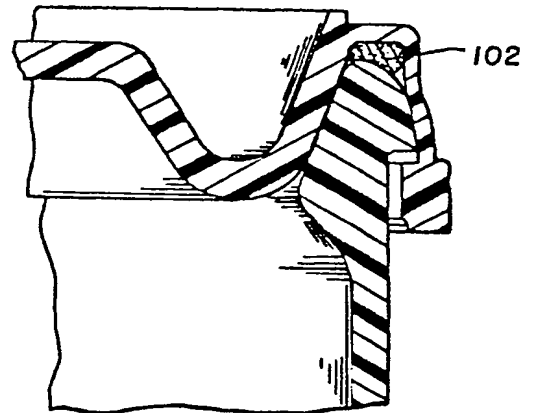




**FIG. 11**



**FIG. 12**



**FIG. 13**